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Federal Communications Commission  
Office of Secretary

**By Hand**

Mr. William Caton  
Acting Secretary  
Federal Communications Commission  
1919 M Street, N.W.  
Washington, D.C. 20036

Re: Apple Computer, Inc.  
ET Docket No. 96-102

Dear Mr. Caton:

On July 15, 1996, Apple Computer, Inc. ("Apple"), filed electronically the attached comments in ET Docket No. 96-102. Apple hereby submits the paper version, as required by the Commission's rules, and moves pursuant to Section 1.46 of the Commission's Rules that these Comments be made a part of the record, even though they are being filed one business day after the July 15, 1996, deadline. Apple's Comments focus on issues of importance that are unlikely to be addressed fully by other commenting parties and, therefore, will provide the Commission with a more complete record. In addition, the brief delay in submitting these Comments will not prejudice the interests of other parties. For these reasons, Apple asks that the Commission grant this motion for late filing of its Reply Comments.

Questions with respect to this matter should be directed to the undersigned.

Respectfully submitted,

*Mary J. Dent*

Mary J. Dent  
Attorney for  
Apple Computer, Inc.

File of Comments received  
10/1/96

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Before the  
FEDERAL COMMUNICATIONS COMMISSION  
Washington, D.C. 20554

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In the Matter of )  
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Amendment of the Commission's Rules to ) ET Docket No. 96-102  
Provide for Unlicensed NII/SUPERNet ) RM-8648  
Operations in the 5 GHz Frequency Range ) RM-8653

To: The Commission

**COMMENTS OF**  
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July 15, 1996

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## SUMMARY

Apple's May 24, 1995, NII Band Petition for Rulemaking described the company's vision for creation of an unlicensed "NII Band" in the 5 GHz range. Along with a petition submitted by WINForum, Apple's Petition formed the basis for the proposals set forth in the NPRM.

Apple welcomes the Commission's decision to embrace the concept of an NII Band and its prompt action to implement the proposals outlined by Apple and WINForum. It strongly supports the Commission's proposal to make available 350 MHz of spectrum for use by "NII/SUPERNet" devices.

Apple, however, believes that the Commission took an overly conservative approach on the maximum power level permitted for all NII/SUPERNet devices. Apple recommends a transmitter power of 0.1 watt (+ 20 dBm) and 0.316 watts (+ 25 dBm) for personal/portable and fixed equipment, respectively, with, of course, the proviso that antenna gain not be restricted for point-to-point, fixed outdoor links.

With respect specifically to longer reach "community networks," the Commission has overemphasized the risk of harmful interference and understated the public need for a low cost, flexible, easily implemented means of meeting the communications needs of those who are underserved by alternative technologies and services. As a result, the Commission proposed certain restrictions on the operation of longer-distance NII/SUPERNet devices that would prevent the development of community networks at 5 GHz and limit the full utility of wireless NII/SUPERNet local area networks.

Community networks must be provided for adequately if the Commission is to satisfy the core goals underlying its NII/SUPERNet proposal. Longer-distance links are an integral part of solving the communications needs of individuals: local area networks, while important, will not provide full value unless they can be connected with the broader information infrastructure. Yet for far too many users, longer distance connections linking them to the broader information infrastructure are unavailable or prohibitively expensive. While universal service requirements can help to alleviate the problem of differential access to the NII, they alone cannot solve it. The Commission must seize this

opportunity to create a low-cost, flexible means for creating longer distance connections.

In its NII Band Petition, Apple proposed that community network links operate with a transmitter output power of up to 1 watt — the same power now permitted under Part 15 spread spectrum rules for use of the 5800 MHz ISM frequencies, whose frequencies match the upper portion of the proposed NII/SUPERNet Band, and for HIPERLAN transmitters in Europe, whose allocated frequencies match the lower portion of the proposed NII/SUPERNet Band. Yet community networks have been tarred with the false and misleading label of “high power” and somehow differentiated from other applications allowed the same power. This has caused the Commission and some other parties to overestimate the possibility that community network links could threaten the reliable operation of other services.

Although one watt ordinarily would not be described as “high power,” Apple believes that community network technologies would not be adversely affected if they were restricted, as Apple has proposed for all NII/SUPERNet devices, to transmitter power of 0.1 watt (+ 20 dBm) and 0.316 watts (+ 25 dBm) for personal/portable and fixed equipment, respectively, with, of course, the proviso that antenna gain not be restricted for point-to-point, fixed outdoor links. These power levels, combined with the use of narrow beam directional antennas, would support the essential requirements of community networking while addressing the concerns that have been raised about operation at a 1 watt output power.

In a further response to concerns about interference, Apple proposes that the Commission adopt a simple over-arching “band plan” that divides the NII/SUPERNet Band into two sub-bands: one optimized for the operation of very high rate (“VHR”) systems, and the other open to all devices meeting the more general NII/SUPERNet technical rules. The VHR-only sub-bands should be located at 5150-5250 MHz and at 5825-5875 MHz, which would provide a total of 150 MHz of spectrum devoted exclusively to VHR-type systems. These sub-bands would be governed by rules addressing solely VHR operations, and technical standards could be designed specifically to meet the unique requirements of very high rate operation. All non-VHR operations, including

community networks, would be excluded from this portion of the NII/SUPERNet Band.

The remainder of the NII/SUPERNet Band — 5250-5350 MHz and 5725-5825 MHz — would be open to all NII/SUPERNet devices, including VHR systems, community network links, and other devices whose users will make a host of tradeoffs between power, bandwidth, and distance. The rules governing these “open access” sub-bands would be more flexible and accommodating than the VHR-only technical rules, and would not be optimized for any particular technology or service

In adopting rules to govern the operation of NII/SUPERNet community network devices, the Commission should not mandate licensing. Fears of a “tragedy of the commons” are based on questionable assumptions and must not be overstated and invoked to prohibit a much-needed technology. In particular, proposals to license NII/SUPERNet community network links ignore the fundamental nature of this type of operation — shared use of the spectrum resource — and would force those who would prefer an unlicensed solution to use a licensed alternative, undermining, perhaps fatally, the development of community networking.

Moreover, there is no reason for the Commission to destroy the promise of community networking by forcing it into a licensed model. Given Apple’s proposed band plan, community networks do not present an unreasonable threat of interference to others using the NII/SUPERNet Band. Licensing also will not lead to more efficient spectrum use. In fact, licensing community network users may lead to decreased spectrum and economic efficiency.

Because the Commission should reject any suggestion of licensing community networks, Apple comments only briefly on the statement in the NPRM regarding potential auctioning of NII/SUPERNet community networking links. The entire premise of a potential is misguided, both because the Commission’s auction authority would not extend to community networks and because any approach based upon licensing by geographic area, such as BTA or MTA, rather than on a link-by-link basis would recreate many of the problems community networks were designed to overcome. For the same reasons that licensing of 5 GHz community network links would be unwise and detrimental

to the interests of those who would be served by these networks, it would be inappropriate to rely solely on other licensed providers to satisfy the appetite for community networking.

While licensing should not be employed, several non-intrusive “hooks” can be used to promote opportunities for cooperation among community network users and, thereby, minimize any theoretical risk of a “tragedy of the commons.” These could include the use of an imbedded unique transmitter ID, a publicly available, on-line data base containing information about users’ equipment, and an informal system for coordination. Prior to adopting any frequency registration and coordination system, however, the Commission should solicit the views of those who would be affected by the system, in particular potential users of unlicensed community network links.

Just as the concept of licensing should be abandoned, so too should the notion of imposing unique regulatory requirements on community networks that are interconnected to the PSTN. While the regulatory status of services provided using unlicensed devices may require Commission consideration, this question is not unique to community networks and need not be resolved in this proceeding.

With respect to technical rules, Apple strongly supports the Commission’s decision to adopt only minimal technical regulations governing operation in the NII/SUPERNet band and to leave the development of additional sharing rules to a more flexible industry process. This approach will maximize the diversity of devices that can operate within the NII/SUPERNet band, while providing adequate “ground rules” to promote efficient spectrum use and prevent interference to other services.

The “interim rules” proposed by the Commission and derived from the rules in Subpart D, however, are not appropriate for use even on an interim basis. Rather than adopting interim rules, the Commission should set strict timeframes within which industry must develop sharing rules — one year from the NPRM date for rules governing operation within the VHR-only bands, and six months from the date on which a Report & Order is released in this proceeding for the general use bands — and should prohibit the introduction of NII/SUPERNet devices prior to these dates



Finally, while the Commission should endorse the principles underlying Apple's proposed "Part 16" approach, it need not create a new "Part 16" in its regulations. Specifically, the Commission should adopt an approach similar to that used for the Data-PCS bands at 1910-1930 MHz and 2390-2400 MHz and the millimeter wave bands at 59-64 GHz, including a reference to NII/SUPERNet use in the Table of Frequency Allocations, providing the spectrum certainty required for reliable operations, and promoting the development by industry of sharing rules and assure that any such rules provide fair and equitable access to the spectrum for all NII/SUPERNet devices. This approach is fully consistent with both the Communications Act and Commission precedent, and addresses the Commission's obligation under Sections 303(g) of the Communications Act and Section 706 of the Telecommunications Act of 1996.

**Before the  
FEDERAL COMMUNICATIONS COMMISSION  
Washington, D.C. 20554**

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Provide for Unlicensed NII/SUPERNet	)	RM-8648
Operations in the 5 GHz Frequency Range	)	RM-8653
	)	

To: The Commission

**COMMENTS OF APPLE COMPUTER, INC.**

Apple Computer, Inc. ("Apple") hereby comments on the Notice of Proposed Rulemaking ("NPRM") issued in the above proceeding on May 6, 1996. Apple's May 24, 1995, NII Band Petition for Rulemaking (the "Petition") described the company's vision for creation of an unlicensed "NII Band" in the 5 GHz range of frequencies, capable of meeting the growing demand for both high capacity and longer distance data communications links.<sup>1</sup> This Petition, along with a petition submitted by WINForum, formed the basis for the proposals set forth in the NPRM.

Apple welcomes the Commission's decision to embrace the concept of an NII Band and its prompt action to implement the proposals outlined by Apple and WINForum. Apple strongly supports the Commission's proposal to make available 350 MHz of spectrum at 5150-5350 MHz and 5725-5875 MHz for use by a new category of unlicensed technologies, referred to in the NPRM as "NII/SUPERNet" devices.

Apple, however, believes that the Commission took an overly conservative approach on the question of longer reach "community networks." With respect to this use of the NII Band, the Commission has overemphasized the risk of harmful interference and understated the public need for a low cost,

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<sup>1</sup> Apple Computer, Inc., "NII Band Petition for Rulemaking," RM-8653 (filed May 24, 1995).

flexible, easily implemented means of spanning rural spaces, extending information access throughout smaller municipalities, and unifying school, library and hospital districts with broadband data connections. Because of these fears, the Commission proposed that community networking devices be allowed to operate, if at all, only in the 5725-5875 MHz band; that these devices perhaps be subject to a limit on antenna gain; and that potential users of community networks perhaps be forced to comply with licensing requirements and, in some cases, be forced to bid for spectrum at auction.<sup>2</sup>

Taken together, these proposed restrictions would prevent the development of community networks at 5 GHz. Moreover, since these longer reach networks are simply a continuation of and complement to the high-capacity local area networks ("LANs") in the NII/SUPERNet Band, these restrictions would limit the full utility of such LANs as well. Community networks are an essential aspect of Apple's NII Band proposal and, therefore, Apple will devote the bulk of these comments to a discussion of the means necessary to permit community networks to operate throughout the NII/SUPERNet Band.

Apple, however, believes that the Commission took an overly conservative approach on the maximum power level permitted for all NII/SUPERNet devices. Apple recommends a transmitter power of 0.1 watt (+ 20 dBm) and 0.316 watts (+ 25 dBm) for personal/portable and fixed equipment, respectively, with, of course, the proviso that antenna gain not be restricted for point-to-point, fixed outdoor links.<sup>3</sup>

With respect specifically to longer reach "community networks," the Commission has overemphasized the risk of harmful interference and

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<sup>2</sup> NPRM at ¶¶ 48, 55.

<sup>3</sup> The Commission's projection of indoor communications distances for 0.1 watt EIRP devices, with effective bandwidths of 20 or more MHz, is optimistic. The rules under which Section 15.247 LAN devices operate, allow 1 watt of transmitter power and 4 watts EIRP, 16 dB higher than proposed in the NPRM. The proposed power limit is not consistent with the HIPERLAN specification in its present form which permits 1 watt and is keyed to an "expected" range for HIPERLAN devices that is at the lower limit of the Commission's description. As discussed below, Apple recommends higher transmitter powers and higher EIRP in the entirety of the NII/SUPERNet band, depending upon the nature of the equipment.

understated the public need for a low cost, flexible, easily implemented means of spanning rural spaces, extending information access throughout smaller municipalities, and unifying school, library and hospital districts with broadband data connections. For these reasons, the Commission proposed that community networking devices be allowed to operate, if at all, only in the 5725-5875 MHz band; that these devices perhaps be subject to a limit on antenna gain; and that potential users of community networks perhaps be forced to comply with licensing requirements and, in some cases, be forced to bid for spectrum at auction.<sup>4</sup> In brief, but discussed in greater detail below, an appropriate band usage plan and other technical and administrative sharing measures can assure that community networks can fulfill their proper role without harming other NII/SUPERNet users or existing users of 5 GHz frequencies.

**I. THE GOALS SET FORTH IN THE NPRM REQUIRE COMMUNITY NETWORKS.**

In the NPRM, the Commission described the core goals underlying its NII/SUPERNet proposal. These include the following:

- Facilitating wireless access to the National Information Infrastructure ("NII");
- Offering new opportunities for providing advanced telecommunications services to educational institutions, health care providers, libraries, businesses, and other users, thereby significantly assisting in meeting universal service goals and encouraging the provision of advanced telecommunications to all Americans as required by the Telecommunications Act of 1996;
- Fostering the development of a broad range of new devices and services that will stimulate economic development and the growth of new industries; and

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<sup>4</sup> NPRM at ¶¶ 48, 55

- Promoting the ability of U.S. manufacturers to compete globally by enabling them to develop unlicensed digital communications products for the world market.<sup>5</sup>

The NPRM then focused almost exclusively on wireless LANs, but the Commission's goals cannot be satisfied by indoor LANs alone. While the Commission stated that it "finds merit" in the concept of longer range networks, it shied away from proposing that such networks effectively be permitted in the NII/SUPERNet Band. This preoccupation with wireless LANs and the apparent, but unwarranted, fear of community networks will frustrate the public's ability to use the NII/SUPERNet Band to meet communications needs that can be met by no other technology or service and will prevent the Commission from achieving fully the most important goals outlined in the NPRM.

Community networks should be among many other NII/SUPERNet functions that users can trade off on a case-by-case, individual basis. These functions will include numerous permutations of distance (from local area to multiple-km point-to-point connections); varying bandwidth or data rates (from perhaps 50 kbps to tens of Mbps); levels of reliability (from *life-critical* information links that should use unlicensed systems only if licensed radio services are not available, to *life-enhancing*, best-effort information conduits); degrees of complexity (from blister-packed complete systems to individually engineered networks); and costs (from basic devices to those incorporating enhanced features).

**A. No Other Technology Serves The Needs That Would Be Served By Community Networks.**

No existing licensed or unlicensed, wired or wireless technology can support the mix of bandwidth, distance, and cost that community networks would make possible. As discussed in greater detail in Apple's prior submissions in this proceeding, existing unlicensed bands at 2 GHz and the ISM bands at 900 MHz, 2.4 GHz, and 5.8 GHz do not include sufficient spectrum to accommodate high speed connections, particularly in environments shared by multiple users. The recently-allocated unlicensed band at 59-64 GHz will be

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<sup>5</sup> NPRM at ¶¶ 1-2.

suitable for high speed connections but, due to the band's oxygen absorption characteristics and the comparative opacity of walls and partitions, will be limited to short range, little more than in-room, communications.

Fiber optic networks, of course, cannot provide mobility and, for many users, are unavailable or prohibitively expensive. Traditional fixed microwave networks licensed under Part 94 of the Commission's rules are orders of magnitude more expensive than unlicensed links, placing them out of financial reach for many who either cannot afford their costs or do not require — and therefore are unwilling or unable to pay for — the reliability they deliver. Licensed wireless mobile networks, such as cellular, SMR, CDPD, and PCS, do not approach the data rates required for multimedia and other broadband applications, nor, in fact, can students, teachers, families and many other user communities routinely afford the usage-based charges for these carrier-provided services.

Apple long has been a proponent of wireless LANs. Indeed, much of Apple's NII Band Petition, as well as its previous efforts to gain frequencies for Data-PCS, reflects the company's belief in the importance of flexible, low cost, unlicensed local area data networks. Wireless LANs, with ranges up to several tens of meters inside buildings, can provide on-site mobility and ready access to internal networks at multi-media data rates. These LANs also can offer local-connection "fan-out" in a building from access points to the (wired) NII, including the Internet, if such wired connection points exist on the premises. For example, large-bandwidth wireless LANs will be a powerful, cost-reducing complement to the National Cable Television Association's recently announced program to install cable modems and provide free Internet access at one point each within several thousand schools. Wireless LANs will make it possible for these schools to extend their networks throughout their buildings and campuses.

**B. Community Networks Complement LANs.**

Local area networks, while important, will not provide full value unless they can be connected with the broader information infrastructure. The rapid growth of the Internet and the World Wide Web indicate users' appetites for links that bring them into contact with individuals, institutions, and repositories of information outside their immediate communities. These connections must be

provided for if the promise of the NII and the guarantee of universal service are to be realized in a meaningful way.

Yet for far too many users, longer distance connections linking them to the broader information infrastructure are unavailable or prohibitively expensive. Even simple digital dial-up connections, which provide only limited functionality, are unavailable to one out of every five Americans.<sup>6</sup> Many people do not have local access to the Internet and must pay long distance charges for each minute they spend communicating.<sup>7</sup> Greater bandwidth wired connections, such as ISDN lines or T-1 connections, cost from hundreds to tens of thousands of dollars annually and often have high up-front and/or per minute charges associated with them.<sup>8</sup> Moreover, in obtaining each of these services, users are tied to a common carrier's pricing and network build-out decisions. Competition in local exchange markets may ease some of these problems, but real change is unlikely in the near future for most of the 56 million people living in rural areas and small cities.<sup>9</sup>

### **C. Community Networks Foster Universal Service.**

Universal service requirements can help to alleviate, but cannot solve, the problem of differential access to the NII. For individual users in rural and high-cost areas, universal service programs likely will cover a fairly limited set of

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<sup>6</sup> According to the New York Times, 20 percent of all households are limited to rotary dial tones, and this phenomenon is even more prevalent in rural areas. New York Times, "Future Communications," p. D3 (March 4, 1996).

<sup>7</sup> See, e.g., Comments of Russell Imrie, Resource Coordinator, Costanoan Indian Research Inc., RM-8653 (filed July 18, 1995) (describing the difficulties faced by a tribal group located within sight of the Silicon Valley but for whom electrical utility service is non-existent and all telephone communication is long distance); Comments of Kentucky Library Network, Inc., RM-8653 (filed July 21, 1995) ("[v]ery few institutions have local access to the Internet"); Comments of the South Carolina Library Association, RM-8653 (filed July 24, 1995) ("small towns and rural communities face enormous obstacles to achieving affordable Internet access under the present set of technology options"); Comments of the Eastern Shore Public Library, RM-8653 (filed July 11, 1995) ("it is a long distance telephone call from here to our local hospital").

<sup>8</sup> See, e.g., Comments of the Center for Democracy and Technology, RM-8653 (filed July 10, 1995); Comments of Michael Chui, Executive Director, HoosierNet, RM-8653 (filed July 10, 1995) ("some of the most important factors preventing widescale deployment of the National Information Infrastructure technologies are the cost and downright unavailability of local high-speed digital communications bandwidth").

<sup>9</sup> See "Future Communications," *supra* n.4 (in 1990, 35.1 million people lived in rural areas and 20.9 million people lived in small cities)

services: perhaps more than "POTS," but almost certainly not high speed links. While schools and libraries likely will have access to a wider range of discounted services under Section 254(h)(1) of the Telecommunications Act of 1996, even this entitlement will not provide a complete solution. Debates are raging about the scope of the rights conferred by Section 254(h)(1), and it remains unclear how broad a collection of services schools and libraries will be entitled to receive, and at what rate.

Even if mandatory universal service programs could encompass high speed connections to all communities, libraries, and schools, there would still be a compelling need for community networks. By creating a low-cost, flexible means for creating longer distance connections, the Commission would reduce the costs of supporting universal service. This reduction would be in the interest of all parties: those who will fund universal service, those who will provide these services, as well as the intended beneficiaries of the universal service program.

In the coming years, policy makers will have to make a series of difficult tradeoffs between relegating some users to a "lesser" status in the information economy and imposing insupportable burdens on telecommunications carriers and users. Community networks can help to alleviate this problem by making it possible for communities of users to create their own connections capable of providing an acceptable level of service at an affordable price, designed around the individual requirements of a particular user group. These links could be used to span rural spaces, join communities, extend information access throughout smaller municipalities, and unify school, library, and hospital systems.<sup>10</sup> The opportunity to create such a solution is one the Commission must seize.

## **II. COMMUNITY NETWORKS ARE NOT "HIGH POWERED" AND WILL NOT POSE UNACCEPTABLE INTERFERENCE RISKS TO OTHER SPECTRUM USERS.**

In its Petition, Apple proposed that community network links operate with a transmitter output power of up to 1 watt. One watt is the power now

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<sup>10</sup> See, e.g., Comments of Duncan, Weinberg, Miller & Pembroke, P.C., RM-8653 (filed July 10, 1995) (describing how state and local governmental entities could benefit from longer-reach unlicensed communications technologies) (filed July 10, 1995).



permitted under Part 15 spread spectrum rules for use of the 5800 MHz ISM frequencies, whose frequencies match the upper portion of the proposed NII/SUPERNet Band.<sup>11</sup> One watt also is the power permitted for HIPERLAN transmitters in Europe, whose allocated frequencies are included in the lower portion of the proposed NII/SUPERNet Band

Community networks, however, have been tarred with the false and misleading label of "high power" and somehow differentiated from other applications allowed the same power. This has caused the Commission and some other parties to overestimate the possibility that community network links could threaten the reliable operation of other services — including those now operating with the same or greater power and higher antenna gain limits than Apple proposed for community networks.

Nonetheless, although one watt ordinarily would not be described as "high power," Apple believes that community network technologies would not be adversely affected if they were restricted to transmitter power of 0.1 watt (+ 20 dBm) and 0.316 watts (+ 25 dBm) for personal/portable and fixed equipment, respectively, which Apple recommends for all NII/SUPERNet devices, with, of course, the proviso that antenna gain not be restricted for point-to-point, fixed outdoor links.

The essential longer reach of community networks would be achieved not through the use of "high power" transmitters, but rather by permitting the use of narrow beam directional antennas that concentrate relatively low transmitter power towards a distant point. Such concentration in the "right" direction originally was a feature of unlicensed use of the 5.8 GHz band pursuant to Part 15; even after limits on the use of directional antennas in this band were adopted, some companies' point-to-point products have been permitted to operate free from this restriction.<sup>12</sup> Furthermore, the Commission recently has proposed to reinstate high gain directional antennas without power penalty in the 5.8 GHz

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<sup>11</sup> See 47 C.F.R. § 15.247(b).

<sup>12</sup> See, e.g., Letter from William F. Caton to Richard E. Wiley, FCC 96-269, 31030/EQU/4-2-7, 1300C2 (dated June 18, 1996) (extending waiver permitting Cylink Corporation to employ directional antennas without limit on gain).

band, subject to certain eligibility or usage restrictions.<sup>13</sup> That proposal mirrors in most respects the essential characteristics of Apple's community networks proposal.

Contrary to the fears echoed in the NPRM, narrow-beam, point-to-point community networking operations present no more threat to other users of 5 GHz frequencies than presented by greater proximity of the transmitters and receivers of any mix of radio services or technologies. If anything, informal coordination or cooperation among users of community networks, motivated by "shared self-interest," can improve band conditions overall. In this respect, the fundamental difference between LANs and community networks is how antennas are allowed to be used.

Using 0.316 watt (316 milliwatts) of transmitter power, narrow-beam antennas at each end of the path can provide connections over 10, 20, 30, or 40 km and greater where there is line-of-sight between the transmitter and receiver, depending on a variety of factors including bandwidth of the transmission, terrain and many local conditions. The achievable distance need not become shorter as the frequency increases. Relatively narrow-beam antennas such as parabolic dishes become more effective (that is, provide greater "gain"), for a given physical diameter, as the radio frequency increases. At frequencies around 5 GHz, this increase does considerably more than make up for the almost unmeasurable losses at the higher band.<sup>14</sup>

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<sup>13</sup> Amendment of Parts 2 and 15 of the Commission's Rules Regarding Spread Spectrum Transmitters, Notice of Proposed Rule Making, ET Docket No. 96-8 , 11 FCC Rcd 3068 (released Feb. 5, 1996). Of course, the Commission's proposal is limited to systems using spread spectrum technologies, which impose certain constraints on system design and, therefore, does not provide a complete "community networking" solution.. Apple believes that flexibility similar to that proposed for spread spectrum systems should be afforded to non-spread spectrum systems.

<sup>14</sup> At still higher frequencies, atmospheric attenuation, including the effects of rainfall, have to be considered in planning a point-to-point link. These effects start to come seriously into play at around the 8 to 10 GHz band.

**III. THE NII/SUPERNET BAND SHOULD BE GOVERNED BY A BAND PLAN THAT PROTECTS PRESENT USES WHILE ACCOMMODATING LANs, COMMUNITY NETWORKING, AND OTHER NII/SUPERNET APPLICATIONS.**

The Commission must satisfy the legitimate concerns among other present and authorized users of the frequencies proposed for NII/SUPERNET applications, to assure their continued, unimpaired operation. For any solution to be acceptable, it has to be conservative, straightforward, rational and recognize the higher rights of licensees to use the band.

Now that the Commission has identified the frequencies for the NII/SUPERNET Band and suggested some technical characteristics of the technologies that will be permitted to use the Band, the Commission can weigh sharing and interference potentials generally, without waiting for exhaustive evidence proving compatibility or incompatibility among types of old and new users. A simple over-arching "band plan" based on these conclusions can go a long way towards allaying the fears of existing users of the 5 GHz frequencies, while setting the stage for orderly development and deployment of compatible NII/SUPERNET devices.

In order to promote sharing by NII/SUPERNET devices and between NII/SUPERNET devices and other services, Apple proposes that the Commission adopt a band plan that divides the NII/SUPERNET Band into two sub-bands: one optimized for the operation of very high rate ("VHR") systems, and the other open to all devices meeting the more general NII/SUPERNET technical rules. This band plan is depicted in charts attached to these comments.

**Dedicated VHR sub-bands:** As the Commission recognizes, one of the core functions to be served by the proposed NII/SUPERNET Band will be high speed (20 Mbps or greater), low power, low power spectral density ("PSD"), short-range, predominately indoor LANs, which Apple refers to as very high rate or "VHR" systems. Because these systems can operate most efficiently and reliably within spectrum that is not shared with narrowband devices, Apple proposes that the Commission create a protected environment within which only VHR devices would be permitted to operate<sup>15</sup>. All non-VHR operations,

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<sup>15</sup> Because the development and definition of VHR technologies and standards are in a very early, formative stage, VHR operation would be defined only by general

including community networks, would be excluded from this portion of the NII/SUPERNet Band.

The VHR-only sub-bands should be located at 5150-5250 MHz and at 5825-5875 MHz, which would provide a total of 150 MHz of spectrum devoted exclusively to VHR-type systems. The VHR sub-bands would be governed by rules addressing solely VHR operations, and technical standards could be designed specifically to meet the unique requirements of very high rate operation.

**Open access NII/SUPERNet sub-bands.** The remainder of the NII/SUPERNet Band — 5250-5350 MHz and 5725-5825 MHz — should be open to all NII/SUPERNet devices, including VHR systems, community network links, and other devices whose users will make a host of tradeoffs between power, bandwidth, and distance. The rules governing these “open access” sub-bands would be more flexible and accommodating than the VHR-only technical rules, and would not be optimized for any particular technology or service.

**A. VHR In The “Lower” Band.**

The contiguous 200 MHz of the “lower” portion (5.150-5.350 GHz) of the proposed NII/SUPERNet Band is presently used or allocated for a variety of navigation aids, public and government satellite uplinks and downlinks, and government and public radiolocation operations. Apple proposes that NII/SUPERNet Band usage in the 100 MHz (5.150-5.250 GHz), where most of the sensitive licensed services operate, would be restricted to indoor VHR LANs. Community network and other NII/SUPERNet devices not conforming to the VHR definition would not be allowed in the 5.150-5.250 GHz portion of the band, but could use the other 100 MHz of the lower band. Such a frequency usage scheme could benefit many band occupants licensed and unlicensed.

Apple’s proposal is tantamount to offering “protected” VHR bands and carefully guarded MSS bands. This proposal to create a VHR-only band at 5150-

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characteristics and would not be limited, either by regulation or technical standards, to any specific approach or set of approaches (such as HIPERLAN, “wireless ATM,” or “SUPERNet”).

5250 MHz will provide adequate protection to MSS feeder links from outdoor and longer-reach operations, the two applications that MSS operators have said are the most objectionable aspects of the NII/SUPERNet proposal and the sole reason given in the NPRM for restricting community networks to the upper band.<sup>16</sup> It essentially will replicate a HIPERLAN-type environment, which is, in fact, a VHR environment, compatible with the MSS usage. As the Commission noted, this should assure that sharing issues can be resolved within the United States, given the global nature of MSS operations and MSS operators' need to resolve sharing issues with HIPERLAN systems.<sup>17</sup>

Also in accordance with this plan, HIPERLAN apparatus will be able to operate in the U.S. throughout its "native" European range (5.150-5.300 GHz). U.S.- developed and manufactured HIPERLAN products will be marketable and usable on both sides of the ocean.

With respect to aeronautical radionavigation devices operating below 5150 MHz, Apple concurs with the Commission's conclusion that NII/SUPERNet devices can operate above 5150 MHz without causing objectionable interference, as long as appropriate out-of-band and power limits are adopted in this proceeding.<sup>18</sup> A VHR-only sub-band in the lower 100 MHz of the NII/SUPERNet Band would provide additional protection by preventing the deployment of longer-reach transmitters in spectrum immediately adjacent to the aeronautical radionavigation band.

For the same reasons that VHR systems can operate indoors without threatening MSS uplinks, they also represent little threat to community networks and other NII/SUPERNet functions and should be allowed to operate on NII/SUPERNet frequencies not reserved for their use, as long as they follow the same rules for all other NII/SUPERNet devices

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<sup>16</sup> NPRM at ¶ 47. While the NPRM refers to potential interference to "fixed satellite service in the 5.10-5.35 GHz band" no satellite users other than MSS operators planning to operate feeder links in the 5.15-5.25 GHz band objected to the WINForum and Apple petitions.

<sup>17</sup> NPRM at ¶ 35.

<sup>18</sup> NPRM at ¶ 35.

**B. Community Networks And Other Non-VHR Devices In The Lower Band.**

In the NPRM, the Commission proposed to limit community networking operations to the upper (5725-5875 MHz) band.<sup>19</sup> The reasons for doing so appear to be based upon the inaccurate “high power” label that has been discussed above. Once MSS links and unlicensed VHR systems have been “protected” by the proposed NII/SUPERNet Band plan, community networks and other non-VHR uses can be allowed in the upper half of the lower band.

In fact, the expected high minimum-bandwidth threshold that is to be required of VHR may be considerably more restrictive than some might recognize. There are several technical means for dealing with “multipath” effects on indoor high-data rate systems, but they may require more costly product implementations than might be initially acceptable. As a result, LANs of “only” a few Mbps or those approaching characteristic Ethernet performance may be appealing and, almost certainly, would enter the market quickly if a reasonable long-term spectrum home were to be available. Such devices and systems are part of that continuum already described and as such, they merit a claim to spectrum in both the low and high subbands.

In the longer view, it may also prove important to have “smart” devices that can operate in the VHR mode while within range of other VHR devices, for example to communicate with in-building infrastructure, and then adapting to a longer-range, narrower bandwidth, operational mode when elsewhere. Contiguous spectrum, therefore, for VHR and for other NII/SUPERNet devices is highly desirable.

A 100 MHz “protected” VHR segment of the lower band offers sufficient bandwidth for a group of wireless users, considering the short range of each device, the multiple channels that would be available to each, and the frequency re-use that would be possible. Rather than risk stifling future innovation by limiting VHR access to additional frequencies, however, Apple proposes that VHR systems be allowed to use the entire 350 MHz of the NII/SUPERNet Band.

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<sup>19</sup> NPRM at ¶¶ 47-48.

By the nature of the containment of VHR systems within buildings, as well as the narrow beam-path of community networks, the likelihood of interference to the indoor system would not necessarily be as great as some have predicted. The risks of interference from community networks into indoor LANs, for example, is reduced by the attenuation of 5 GHz signals passing through the exterior walls and windows of a building. This attenuation alone is of similar scale to the directional gain of a small parabolic dish antenna. Achieving satisfactory coverage within a building is not always a easy task, even with all stations inside the building. Disruptive interference from low-power sources outside the building is even less likely. Thus, community networks generally would present no more interference threat to indoor operations than would nearby indoor wireless LANs.

The additional reasons for allowing the full variety of non-VHR systems in half of the lower band have to do with the nature of the upper band.

**C. VHR And Community Networks In The Upper Band.**

The reasons for having a set-aside and “protection” of a substantial VHR LAN domain in the lower band are equally compelling with respect to the “upper” NII/SUPERNet Band (5.725-5.875 GHz). In the latter case, reserving an upper VHR sub-band would provide similar protection to FSS uplinks operating at 5850-5875 MHz and low power unlicensed operations operating under Part 15.249 of the rules.<sup>20</sup> Accordingly Apple proposes such a dedicated VHR band: 5.825-5.875 GHz.

By creating two VHR sub-bands separated in frequency, the proposed band plan would permit cellular-like re-use and would allow co-location of several systems using mutually-hostile technologies, some operating on each of the two different protected sub-bands. Alternately, the channels thus available could be used at a single site to make more aggregate bandwidth available at that location.

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<sup>20</sup> Apple concurs with the Commission’s conclusion that sharing with ITS systems is beyond the scope of this proceeding and will be addressed in future rulemakings as appropriate. NPRM at ¶ 35. Apple notes, however, that the proposed band plan preserves the opportunity to accommodate ITS operations by limiting the NII/SUPERNet use of the spectrum proposed for ITS services to indoor, VHR systems.

Frequency separation of the two VHR sub-bands is essential for effective use of the spectrum. Where VHR channels are contiguous, spillover of a transmitter's emissions envelope, coupled with less-than-ideal receiver skirt selectivity, would make it necessary to reserve a buffer or idle (guardband) channel between multiple contiguous occupied channels at a single location. In the case of three contiguous channels in a single sub-band, a single user of the middle channel could foreclose usage of the channels on both sides. By separating the sub-bands, VHR channels can be created that would afford more VHR capacity than the same amount of contiguous bandwidth, and it would not be necessary as often to "waste" a guardband.

Beyond that, however, the sharing circumstances in the upper band are markedly different. First, the primary occupants of the band are government services, some of which entail radars with megawatts of transmitter power feeding antennas with extraordinarily high gains. Second, the proposed NII/SUPERNet frequencies match those of the ISM band which, while not being used today to a great extent, can become congested with RF energy emitters that are not restricted in any way with respect to in-band power output.

Third, the band already is used for spread spectrum communications under Section 15.247 and several products have been deployed and more are expected. As has been noted, the Commission currently is addressing spread spectrum rule changes that could result in some, but not all, of the additional provisions for using the band that would be required to make the upper band suitable for community networks and other NII/SUPERNet applications. In particular, the requirement to use only spread spectrum technologies has a dampening effect on product development; the primary reason cited for using spread spectrum is not its survivability in some interference and multi-path scenarios, but the fact that a full watt of power is allowed. In many places that community networks would be most valuable, particularly rural environments, much simpler narrower-band technologies would be as effective as spread spectrum.

The proposed spread-spectrum rule change that runs most counter to the goals, spirit and technologies of the NII/SUPERNet Band is that high antenna gains would not be permitted for "the general public," but instead reserved for "business and commercial" users. At some point in the past, such a restriction



may have been reasonable, but the "general public" now owns computers and wants to get on "the Web" and connect in all sorts of locales, especially at home, which in rural areas can be a long way from the nearest Internet provider.

With respect to existing Part 15 users, Apple's proposal is to share the spectrum on a co-equal basis. Apple does not request that any changes be made to the rules governing spread spectrum operations in the 5.7 GHz band, other than those proposed independently in the Commission's spread spectrum rulemaking, and will not seek interference protection from any other Part 15 devices. These conditions will preserve the 5.7 GHz spectrum domain for all existing and future Part 15 users under conditions inherent to Part 15 operation. As noted in Apple's previous submissions regarding the NII/SUPERNet band, the technical rules governing the band must not exclude spread-spectrum modulation technologies explicitly or indirectly. Spread spectrum devices in the bands should be allowed to comply either as Section 15.247 devices or under the more liberal NII/SUPERNet rules, as they may best apply.

Fourth, the 150 MHz of the upper NII/SUPERNet Band are within the 275 MHz (5.650-5.925 GHz) that are allocated to the Amateur Radio Service, on a secondary basis to government operations. In addition to the recognized value of Amateur Service allocations in general, an overall trend of Amateur Service operations is to explore and use ever-higher frequencies such as the "5 cm band." Apple's proposal involves only low-power devices in only part of the Amateur band, which already is available for very similar (or, in some cases, more intrusive) technologies.

In many ways, the functions sought by Apple for community networks are similar to services already provided for many years by the amateur radio community. Perhaps such activities could be made complementary and energized to help schools and other public-benefit entities get "on line." The need to do so has become urgent.